COMPUTERIZED SOIL SURVEY REPORTS

Henry C. de Gooijer
Saskatchewan Institute of Pedology
University of Saskatchewan

The Computerized Soil Survey Reports are an initiative of the Saskatchewan Soil Survey to expand the use of soils information, by existing and potential users, through the use of computers and computer disks. Extending information in a computerized format presents a user with the option of obtaining the soils information required in a format other than the conventional printed report or map.

The Soil Survey has been using micro computers for digitization, data management and laboratory analysis, resulting in most data being stored on electronic media allowing the use of computers to extend the collected information to users.

A larger number of requests for information in an electronic format are now being recieved. In order to meet these needs, it was decided compliment the present written reports and paper maps with a computerized format of soil report which would enhance the access and use of presently collected data.

What are Computerized Soil Survey Reports?

A computerized soil survey report is simply a collection of computer code or programs which allow controlled access to a set of databases containing soils information collected by the Soil Survey and various other agencies. By relating these data bases, a computerized soil report or Soil Information System, can supply a comprehensive information package to a user for a specified area or location.

How the System Works

Soil data or interpretive data is currently represented on maps with symbols and or colors. These colors or symbols are then defined by an adjoining legend. This is not only true for soils maps, but for many types of maps, such as highway or grid road maps as well. The computerized soil report automates the definition process associated with obtaining information from a map. When a soil area or legal location is requested, all map symbols associated with that particular request are compiled and defined. Where a map will supply a symbol ie) CL on a texture map, the computerized report will return the symbol CL plus the definition of CL which would be Clay Loam. The advantages of this feature become much more evident when defining more complex symbols such as agricultural capability, salinity or soil map units.

The computerized report has the definition capability due to the use of relational databases. A number of these data base files contain source information or "raw data" which characterize soil polygon areas or are location specific. The remaining data files serve as look up files supplying definitions for the various symbols used in the soil report or to provide common field linkages between various databases. An example of the latter is the quarter section data base. This file provides the link between soil polygon numbers and legal locations allowing soil survey information to

be accessed on a quarter section basis. The second function of this file, is to allow the integration of information from other agencies collecting land resource data on a quarter section basis in the province. These include, the Land assessment database from the Saskatchewan Assessment Management Agency, Soil Test data from the Saskatchewan Soil Testing Lab and yield information from the Canada Saskatchewan Crop Insurance Corporation.

Subsets of data are drawn from the larger data files of the various agencies. Land assessment data is used to supply land use information, acreage data, land values and final assessment ratings. Soil Test data supplies information such as nitrogen, phosphorus, potassium, sulfur, pH and conductivity as well as organic matter levels and micro-nutrient levels if requested. Crop Insurance provides Risk Area ratings and yield information (15 year actual + calculated) based on the A to P land area ratings.

Information supplied from Soil Survey soil polygon data bases include descriptions of soils, agricultural capability ratings, salinity ratings, landscape features, soil textures, surface pH, wind and water erosion susceptibility ratings, organic matter levels, and wind and water erosion equation variables. A soil polygon data base characterizes a soil polygon but not a specific quarter section location. A quarter section inherits its descriptions from the soil polygon in which it occurs. In the event that a quarter section falls within more than 1 soil polygon, up to 4 polygon numbers may be assigned to that particular quarter.

System Operations

Data is organized on a Rural Municipality basis, therefore only 1 RM can be selected at a time. Once this parameter is established, the choice of gathering information by quarter section or soil polygon area is made. On screen messages and prompts validate the selections and give messages as to the status of program operations. Once the entire data set has been compiled and defined, it can then be viewed on the computer screen. Page formatted printouts can be obtained for the entire data set or for particular categories of data (Table 1. Computerized Soil Survey Report, sample printout). Notes may be added to any printout as an option.

On line help will assist the user if any difficulties occur when running the program. As well, an on line dictionary is offered to supply definitions to some soils terms which may appear on the screen.

Special Use Modules

The system described is an Information Support System. It makes queries of the data sets and presents the data in a format in which an extension worker or agrologist can use for further work or a particular use.

Special use modules are being developed to provide extra query and interpretive powers. The first module is for Soil Conservation. This module queries the various data sets available and presents a one page summary of Soil Conservation and Management Recommendations and Notes. The guidelines for management and conservation practices were supplied by representatives of Saskatchewan Rural

Development, Saskatchewan Agriculture and PFRA.

Future development will occur on modules pertaining to soil fertility and probability of yield calculations using climatic data, if desired by users.

Coverage

The adjoining map (Figure 1. Coverage of Province by Computerized Soil Reports) presents the proposed coverage of the province with Computerized Soil Reports. Data for 70% of the agricultural area of the province will be available by the spring of 1991. No provision has yet been made for agricultural areas north of Township 48.

Future Directions

The computerized Soil reports will evolve with the needs and requirements of present and future users. Complete coverage of the agricultural areas of the province is also desired within the next 5 years. Addition of expanded data sets such as climatic information, available water storage capacities, more concise organic matter information and graphics are also being considered.

System Particulars

The system, which will be available in the spring of 1989, will be a Soil Information Decision Support System which is compatible with all IBM or 100 % compatibles with a minimum of 512K RAM memory.

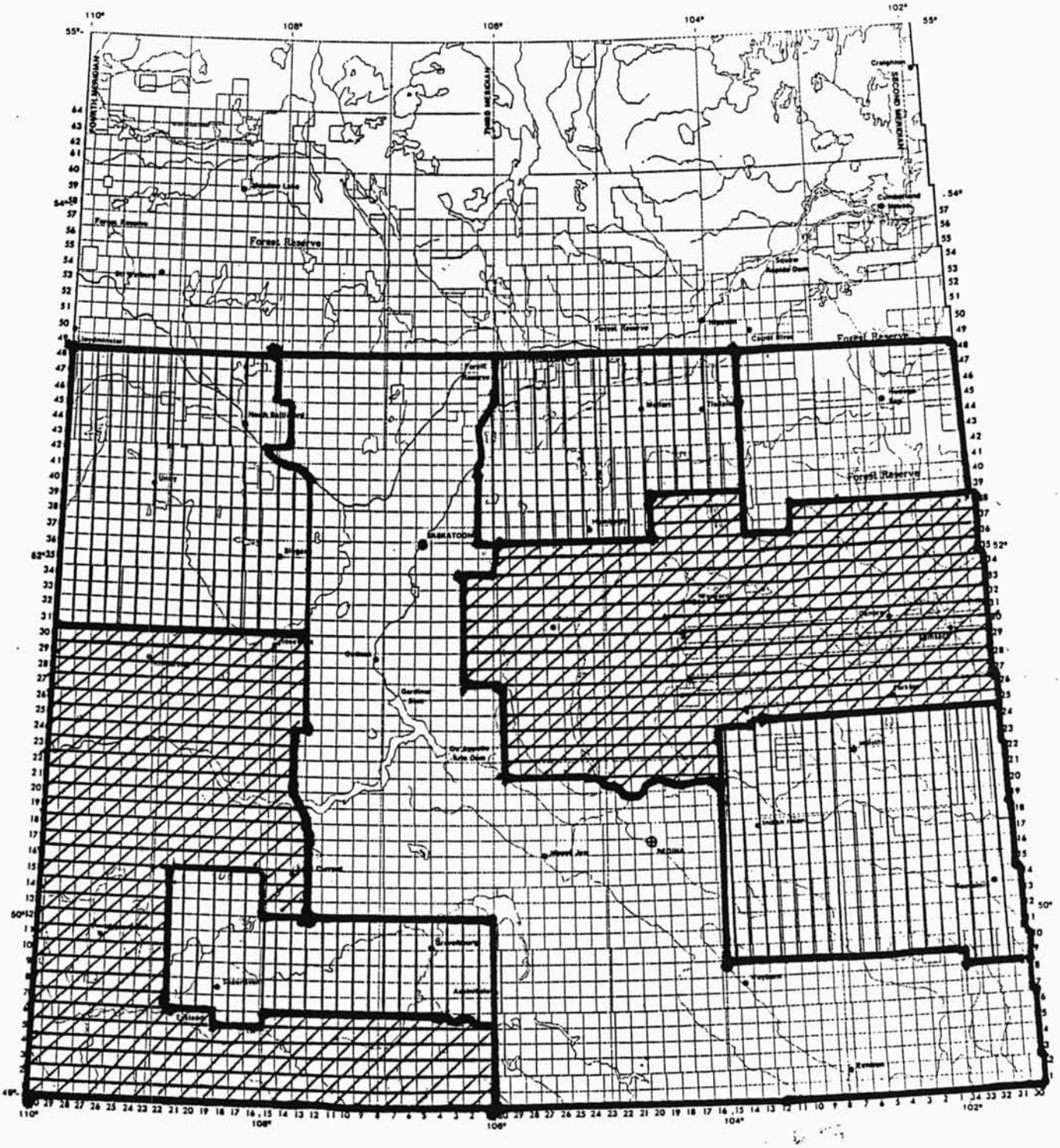
Data will be compiled and organized by Rural Municipality. Data will be distributed on 5 1/4 or 3 1/2 inch diskettes with installation on hard disks as an option. Present data sets for a 9 township Rural Municipality require approximately 250K of disk space. The compiled programs, which require versions of Dos 2.0 or greater to operate, requires approximately 275K of disk space. One set of program software will operate all Rural Municipality data sets.

A conservation module is under development in consultation with representatives from the PFRA, Saskatchewan Agriculture and Rural Development.

Graphics, although a desired component, are not available at the present time. Versions are not available or under development for the MacIntosh computers although this development may occur in the future if required.

Figure 1.

Coverage of Province with Computerized Soil Survey Reports



Phase 1 - Available: Spring 1990

Phase 2 - Spring 1991

Phase 3 - As Survey progresses

Table 1.
Computerized Soil Survey Report Sample Printout

```
SASKATCHEWAN SOIL SURVEY, UNIVERSITY OF SASKATCHEWAN, SASKATOON
RM 409, Buffalo                                    February 15, 1989
LANDOWNER:A. Farmer   Location  Sec:SE 17 TP:41 RG:20 W:3 Area:112
-------------------------------------------------------------------

SOIL RESOURCE SUMMARY INFORMATION
================================

    The Soil Resource information presented for this quarter section
is obtained from a soil polygon database.  The information
describes the soil polygon as a complete unit.  Specific details for an
individual quarter section may vary.
    This quarter section is represented by more than one soil polygon
    More information may be obtained for this quarter section of land
by obtaining information for the following areas:

------------          QUARTER SECTION DIAGRAM
|          |          ----------------------
|  89   112|
|          |
|  89   112|
|          |
------------

SOIL AREA       :112                    89
Soil            :STWR9                  STWR3
Ag. Capability  :3(8)M4(2)N             3(10)M
Salinity        :3MA                    1MA
Landscape       :3-2UD                  2UD
Texture         :L                      L
Wind Erosion    :2                      1
Water Erosion   :2D                     2D
Surface pH      :A2                     A1
Erosion K value: 0.20                    0.20
Erosion I value:   48                      48

VALUES FOR EROSION VARIABLES  (R)=17.5   (C)=25

The Soil Resource information below characterizes soil area: 112
*SOIL NAME  ----------------->:STWR9
              Scott-Weyburn; Dark Brown soils formed in a mixture of
              shallow silty lacustrine material (Scott) and slightly
              stony, loamy glacial till (Weyburn);loam surface textures.

              Mainly orthic Scott soils, with orthic Weyburn soils on
              upper slopes, and saline soils on lower slopes.
=========================================
```

Table 1 cont.

```
*AGRICULTURAL CAPABILITY ----->:3(8)M4(2)N
   80  Percent of Class 3 soils
               have moderately severe limitations that restrict the range
               of crops or require special conservation practices .
               Limitations: - insufficient water holding capacity.
   20  Percent of Class 4 soils
               have severe limitations that restrict the range of crops or
               require special conservation practices or both.
               Limitations: - excessive soil salinity which adversely
               affects crops.
==========================================
*SALINITY ------------------->:3MA
          Approximately 10 to 20 % of the area is affected by
     moderate concentrations of salts
     Salts generally occur throughout low-lying depressional
     areas and sloughs.

      For a more accurate assessment of the severity of the
     salinity problem in a particular area, soil tests are required
==========================================
*SLOPE ----------------->:CLASS 3-2
Dominant Slope
               These slopes are gently sloping with slopes up to 5 % but
               dominantly 2 to 5 %.
Sub dominant slope
               These slopes are very gently sloping with slopes up to 2 %.
     -----> Please note: a one percent slope is a change in elevation
            of one metre in a horizontal distance of 100 metres.
==========================================
*LANDFORM -------------------->:UD
Dominant Landform-->Undulating
                    Landscapes that are characterized by a sequence of
               gentle slopes extending from smooth rises to gentle hollows,
               that impart a wave-like pattern to the land surface are
               called undulating.
Sub dominant Landform--->Dissections
               Shallow gullies occuring along the slope or shallow gullies
               joining one low area or kettle to the next.
==========================================
*SURFACE TEXTURES ------------>:L
TEXTURE 1 ----->:L          Loam     (Medium Textured)
TEXTURE 2 ----->:
==========================================
*SURFACE pH ------------>:CLASS A2
               50% of these soils have a pH between 5.6 and 6.0, 20% with
               6.1 to 6.7, and 30%  with 6.8 to 7.5. ** SOME OF THESE SOILS
               MAY REQUIRE LIMING FOR MAXIMUM YIELD **

==========================================
*WIND EROSION ---------->:CLASS 2
Erosion potential-->Low
               Soils in this class have a low susceptibility to wind
               erosion.  Good farm management and average growing
               conditions may produce a crop with sufficient trash cover to
               protect these soils against wind erosion.

==========================================
```

Table 1 cont.

*WATER EROSION ---------->:CLASS 2D
Erosion potential-->Low
Slight susceptibility to water erosion
-- higher rates of erosion may occur on the steeper slopes along the edge of the dissection or gully if left unprotected

*ORGANIC MATTER LEVELS
100 percent of the soils in this area have an average organic matter level of 4.5 percent.

* ASSESSMENT INFORMATION

The following information was collected by the Saskatchewan Assessment Management Agency
Cultivated Land: 90 Acres. Rating-> 61
Cultivated Land: 53 Acres. Rating-> 36
Cultivated Land: 12 Acres. Rating-> 33
Assessed Value.....: 3842

**** The Canada-Saskatchewan Crop Insurance Land rating for this parcel of land is: SOIL TYPE: J RISK AREA: 20

* 15 YEAR AVERAGE YIELDS FOR J TYPE SOIL.

CROP	Yield/Acre Summerfallow Kg	Summerfallow Bu	Stubble Kg	Stubble Bu
CANARY SEED	434	957	303	669
SPRING RYE	671	26.4	436	17.2
FLAX	463	18.2	323	12.7
CANOLA	529	23.3	343	15.1
DURUM WHEAT	794	29.2	556	20.4
TRITICALE	974	35.8	681	25.0
MUSTARD	439	19.3	285	12.6
BARLEY	1051	48.3	788	36.2
FIELD PEAS	652	23.9	490	18.0
HARD RED SPRING WHEAT	863	31.7	647	23.8
UTILITY WHEAT	963	35.4	674	24.8
LENTILS	387	854	290	639
OATS	876	56.8	613	39.7

^^^^Yields for Lentils and Canary Seed in Lbs/acre

* Saskatchewan Soil Test Lab Data

YEAR	DEPTH	NITROGEN	PHOSPHORUS	POTASSIUM	SULFUR	pH	CONDUCTIVITY
85	0-6	64.0	24.0	520	26.0	6.7	1.1
	6-12	20.0			26.0	7.5	2.3
	12-24	28.0			52.0	8.0	2.5

Table 1 cont.

*SOIL CONSERVATION and MANAGEMENT RECOMMENDATIONS/NOTES

The following is a general list of Soil Conserving practices and/or Conservation Notes for this quarter section. The general practices are provided as viable soil conserving options, some of which may suit your farming operations and interests. For more specific information about these practices and/or notes,consult your local Soil Conservationist or Extension Agrologist.

*Recommended Soil Conserving Practices:

Salinity Control:i) alfalfa or extended/continuous or flexible cropping
ii) forage and/or perennial grasses
iii) salt tolerant grasses

Conservation Tillage/Trash Management:
i) reduced/minimum tillage
ii) lift harrows and reduced tillage speed
iii) wide blade cultivator
iv) partial or total chemical fallow

* GENERAL RECOMMENDATIONS FOR THE AMOUNT OF SURFACE TRASH REQUIRED TO REDUCE THE EROSION RISK

BLOCK FARMING (1000-2000 FT WIDTHS)		STRIP FARMING (150-300 FT WIDTHS)	
TEXTURE	LBS SURFACE RESIDUE	TEXTURE	LBS SURFACE RESIDUE
Sands	1600 - 1650	Sands	1300 - 1650
Loamy Sands	1200 - 1300	Loamy Sands	900 - 1100
Clays&Silt Loams	1000 - 1100	Clays&Silt Loams	500 - 800
Loams	600 - 700	Loams	0 - 250
Clay Loams	600 - 650	Clay Loams	0

Low Soil pH: i) addition of CaCO3 or Lime
Strip Farming
Grass/Annual Barrier Strips
Shelterbelts

*CONSERVATION NOTES

*REASON FOR ENQUIRY .....NOTES
This is a sample printout for the Soils and Crops Workshop 1989. Notes may be added to the printout in this area (optional).